Dec. 21, 1954 W. L. SIEGERIST 2,697,489

SEVERING APPARATUS FOR CONTINUOUSLY MOVING MATERIAL

Filed Oct. 24, 1951 4 Sheets-Sheet 1

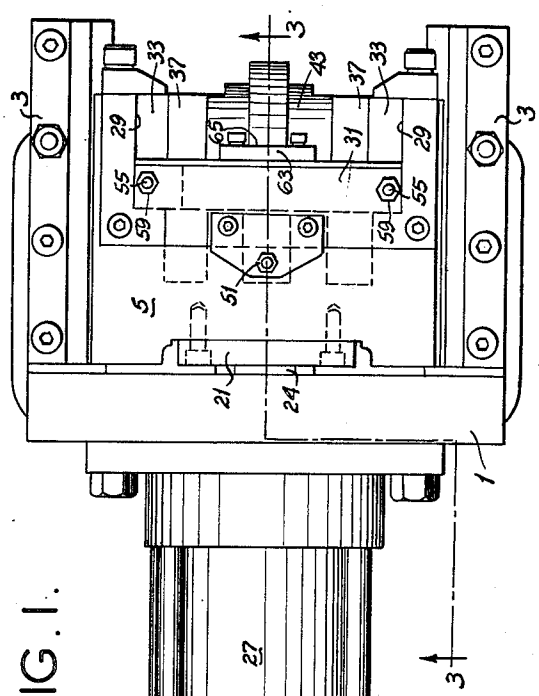


FIG. 1.

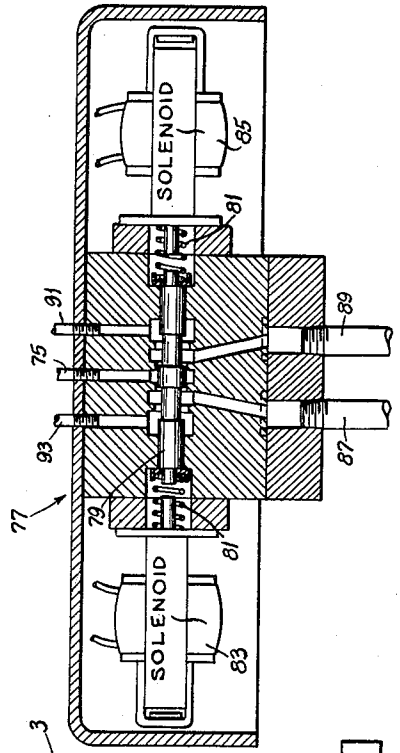


FIG. 8.

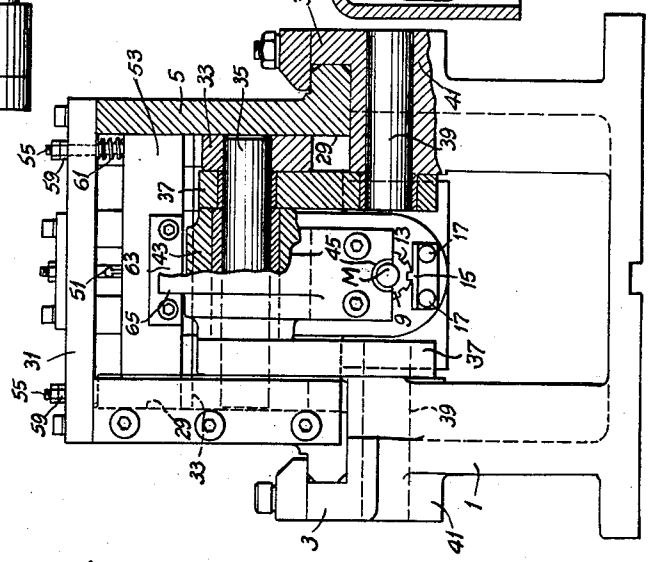


FIG. 2.

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SEVERING APPARATUS FOR CONTINUOUSLY MOVING MATERIAL

Filed Oct. 24, 1951 4 Sheets-Sheet 2

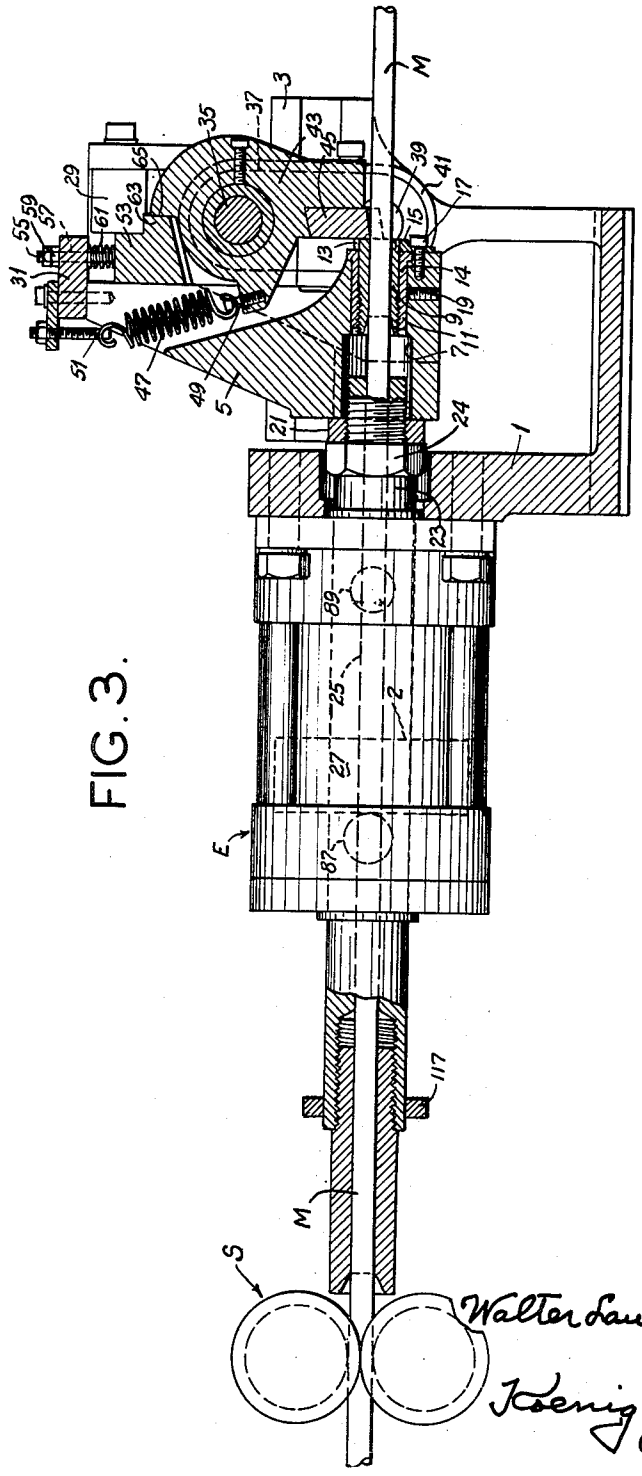


FIG. 3.

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SEVERING APPARATUS FOR CONTINUOUSLY MOVING MATERIAL

Filed Oct. 24, 1951 4 Sheets-Sheet 3

FIG. 4.

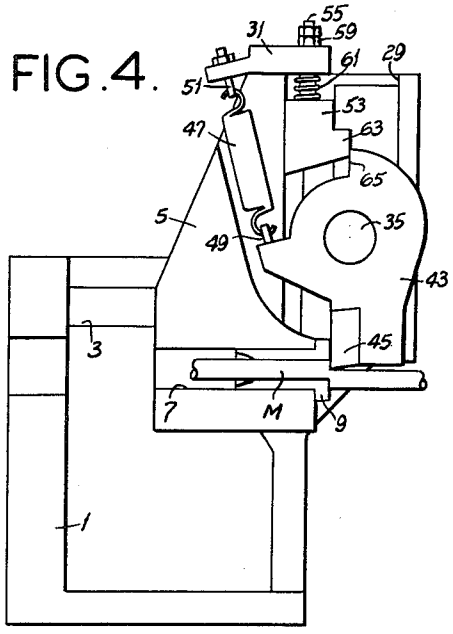


FIG. 5.

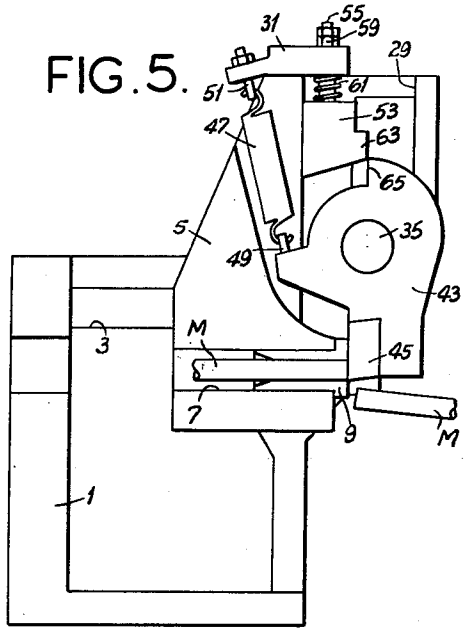


FIG. 6.

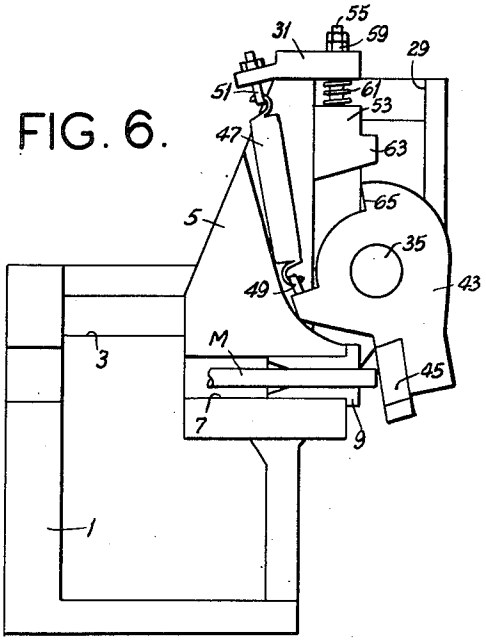
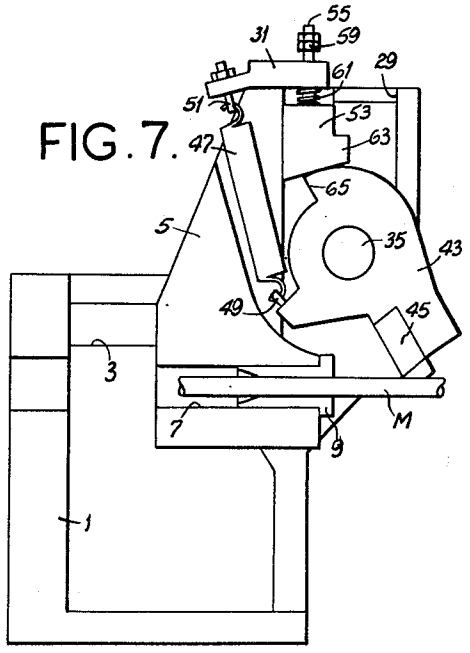


FIG. 7.



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Dec. 21, 1954 W. L. SIEGERIST 2,697,489

SEVERING APPARATUS FOR CONTINUOUSLY MOVING MATERIAL

Filed Oct. 24, 1951 4 Sheets-Sheet 4

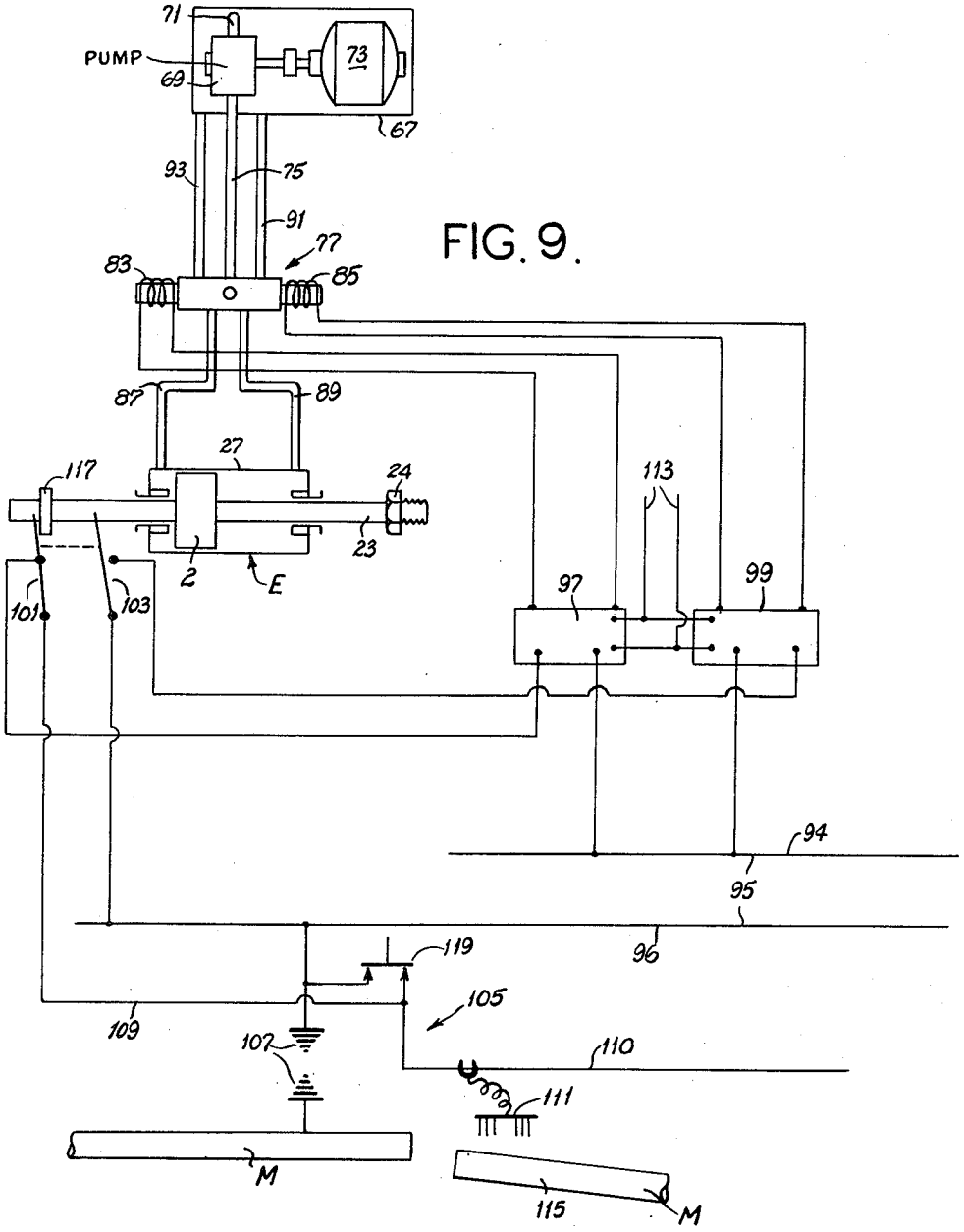


FIG. 9.

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United States Patent Office

2,697,489

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SEVERING APPARATUS FOR CONTINUOUSLY MOVING MATERIAL

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Application October 24, 1951, Serial No. 252,959

12 Claims. (Cl. 164—49)

This invention relates to severing apparatus, and with regard to certain more specific features, to apparatus of this class for automatically segmenting continuously moving material or articles. It is an improvement in the general class of construction such as shown in U. S. Patents 1,911,150 and 1,836,712, both by K. W. Hallden.

Among the several objects of the invention may be noted the provision of accurate, high-speed, comparatively light-weight severing apparatus for cutting material of substantially continuous length; the provision of apparatus of the class described which may be organized with any machine providing a continuous supply of the material to be severed, with or without a mechanical coordination with said machine; and the provision of severing apparatus of the class described which may be easily, quickly and accurately controlled for changes in the severed lengths. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a top plan view of the apparatus shown in retracted position;

Fig. 2 is a right-end view of Fig. 1, parts being broken away for illustration;

Fig. 3 is a vertical section taken on line 3—3 of Fig. 1, showing said retracted position of parts;

Figs. 4–7 are schematic views based upon Fig. 3 but illustrating a sequence of positions and functions throughout a cutting cycle;

Fig. 8 is longitudinal section of an operating valve; and

Fig. 9 is a schematic view of an adjustable timing control.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

The invention accomplishes severing of material which continuously moves through the severing apparatus. Briefly, the invention consists of a carriage which is forwardly movable from an initial position in the direction of movement of the material through a severing stroke and back through a return stroke to the initial position. On the carriage is a severing member movable therewith in the direction of movement of the material. This severing member has an additional movement relative to the carriage but is locked against this additional movement during the severing action which carries the severing member across the material. After the material has been crossed and severed, the lock is released so that continued movement of the material immediately pushes aside the severing member. Hence the carriage and the severing member may start at once to execute a return stroke. After execution of the return stroke the severing member is automatically locked against said additional movement, being thus prepared for the next cycle of operations. Unlike prior devices, the present one is not required to move the carriage along with the material after severance in order to clear the severing member from oncoming material.

Referring now more particularly to the drawings, there is shown at numeral 1 a frame having horizontal guides 3 which support a movable carriage 5 of generally arch shape (Figs. 2 and 3) which may reciprocate in the guides. This carriage has an opening 7 through it for

passage of a continuous length of the article or material M which is to be severed. This material feeds out continuously from the machine which supplies it, as, for example, a straightening machine. The material may be in the form of a wire, rod, strip, or the like. In the present example, the material M is illustrated as being a continuous length of rod issuing from a straightening machine shown diagrammatically at S. The material moves continuously at a speed depending upon the production rate of the supplying machine.

At the outlet of the opening 7 is mounted a first severing element or cutting die 9, which in the present case is constituted by a hardened flat-ended cylinder adjustably threaded into a bushing 11 and held in place by a set screw 19. The die 9 is provided exteriorly with castellations 13 for adjustment by means of a spanner wrench. A locking member 15, held by a cap screw 17, cooperates with the castellations 13 to lock the die against rotation after threading adjustment.

The carriage 5 carries a rearward yoke 21 to which is threaded a hollow piston rod 23. A hexagonal portion 24 serves as means for applying a wrench to thread the rod into position. A passage 25 through the piston rod serves to admit the moving material to and through the opening 7 and die 9 in the carriage 5. The piston rod 23 forms part of a reciprocating hydraulic engine E. The cylinder of the engine is shown at 27. This cylinder carries the piston 2 (Fig. 9) on the piston rod 23. A valve 77 serves to cause the engine to reciprocate once, in response to an appropriate action, further details of which appear below.

The carriage 5 includes sidewise vertical guides 29 which are bridged by a plate 31. Slide blocks 33 are constrained to move vertically in the guides 29. These blocks are connected by a crankpin 35 passing through double crank elements 37. The crank elements are carried on double crankshaft sections 39 which are rotary in aligned bearings 41 in the frame 1. Supported upon the crankpin 35 between adjacent cheeks of the crank elements 37 is a ram 43. This ram carries at its lower end a second severing element or cutting tool 45 for shearing cooperation with the end of the cutting die 9. The ram 43 is normally biased clockwise to hold the tool 45 against the end of the die 9. This is accomplished by a tension spring 47, which reacts between an anchor 49 on the ram 43 and an adjustable anchor 51 supported upon the plate 31.

Beneath the plate 31 is a vertically slidable block 53 from which extend studs 55. These extend through openings 57 in the plate 31 for vertical sliding movement. Adjustable heads 59 on the studs 55 limit downward movement of the block 53. Springs 61 bias the block downward but allow upward movement with a resilient reaction. On the front of the block 53 is a hardened catch 63 for engagement by a latch element 65 on the ram 43. Thus when the catch 63 is behind the latch 65, the ram 43 is held in a vertical position, with the cutting tool 45 against the front face of the die 9 (see Figs. 1–5). When the ram 43 is moved downward by elements 37 and 39, the latch element 65 retracts from the catch 63 (which it is about to do in Fig. 5). Thereafter the ram 43 is free to rotate counterclockwise under circumstances to be described (Figs. 6 and 7). In this event the latch 65 may move under the catch 63 which at this time has reached its lowermost position as determined by the head stops 59. Then if the ram is returned to its initial vertical position and lifted, the block 53 is lifted by the rising ram against the reaction of springs 61. As the latch 65 is rotated clockwise, also under circumstances to be described, the latch 65 moves from under the catch 63, which under bias of spring 61 drops behind the latch. This again locks the ram 43 in vertical severing position, such as shown in Fig. 3.

Upon a reciprocation of the carriage 5 from left to right and return, as viewed in Fig. 3, action takes place as shown in Figs. 3–7, assuming that the material M is moving at a constant speed to the right. Initial movement of the carriage to the right moves forward the pin 35. Being constrained by the slide blocks 33 in the vertical guides 29, the pin 35 by reason of its mounting on members 37 centered at 39 has a

vertical component of movement relative to the carriage which is imparted to the ram **43**. At this time the ram cannot rotate in either direction, being constrained by the contact of latch **65** on catch **63** and by contact between the tool **45** and the end of die **9**. Thus the ram **43** moves forward and downward through positions each parallel to the other, such as shown in Figs. 3–5. At this time the tool **45** shears through the advancing material M. The forward velocities of the material and of the severing elements **9** and **45** are at this time equal. Finally the material is sheared off. As indicated in Fig. 5, the block **53** has been adjusted by means of head stops **59** to cause the catch **63** at this instant to release the latch **65**. This occurs at or near the end of the right-hand stroke of the carriage **5**. Thereafter, the carriage returns while the oncoming material M continues its movement in the opposite direction. This causes the ram **43** to rock counterclockwise (Fig. 6), thus clearing the material M which can then move under the tool **45** (Fig. 7). The spring **47** stretches and applies a return bias to the ram **43**. Upon the return stroke of the carriage **5**, the center of the crankpin **35** again retracts and rises, thus lifting the ram **43**. This lifts the block **53**. As the rise takes place, the spring **47** rotates the ram **43** clockwise until it becomes vertical, at which time the latch **65** releases the catch **63** to drop in behind the latch under action of the springs **61**. The device is then prepared for the next cycle of operation.

Upon initial movement from the Fig. 3 position toward the Fig. 4 position, cutting starts immediately, the moving parts being coordinately locked with the material M. Since at this time the downward component of movement of the tool **45** is small, its cutting force is relatively large. This is at the time when such force is most required. As the downward component of velocity of the tool **45** increases and its cutting force decreases, the point is reached at which break-away shearing occurs (Fig. 5). Up until this point, the motions of the material M and the forward component of motion of the tool **45** are equal, because the severing elements grip the material during severance. If the material M normally moves at a speed greater than that of the carriage **5** and is stiff enough, it aids the piston **2** in pushing the mechanism. If the material is flexible, such as flat strip, and tends to move forward at such greater speed, a loop is allowed to form ahead of the engine E, suitable space and a table being provided for this purpose between the device and the machine which is feeding the material M to it. An advantage of the shear herein described is that its cross-cutting action is so rapid that the flow of material is not long interrupted, thus minimizing the loop, even though the movement of the shear in the direction of the material movement may be less than the latter, say by as little as one-half. However, if the normal speed of the material M is not greater than, or slower than the forward speed of **9** and **45**, this looping does not occur. In the event of the slower normal speed, whether the material is stiff or flexible, the action of the severing machine exerts a pull on it tending to withdraw it from the supplying machine. This brakes the action of the severing mechanism.

In any event, as soon as severance has been effected (Fig. 5), the material M is free to advance and to rotate the ram **43** anticlockwise (Fig. 6), finally running under it (Fig. 7). This anticlockwise movement of the ram **43** is unimpeded, since the latch **65** is beneath and free of the catch **63**. The anticlockwise movement is in fact aided by the return acceleration of the carriage, which causes a very quick and smooth releasing action. Then upon retraction of the carriage **5**, the tool **45** clears the material M (Fig. 7). As the center of rotation of ram **43** rises, the spring **47** pulls the ram into its initial vertical position, at which time the catch **63** automatically drops behind the latch **65** (compare Fig. 7 with Fig. 3). This cocks the ram for the next severance.

The lower surfaces of the block **53** and of the catch **63** are formed as a sloping plane for the purpose of providing a free entry of the latch **65** under the catch **63** upon the return stroke, that is, when the ram **43** is angled as shown in Figs. 6 and 7.

Timing of the reciprocation of the carriage **5** may be effected in response to action of the machine supplying the material M, but this is not a necessity since the timing may also be effected manually or responsively to the movement of the end of the material M as it moves out from the cut-off mechanism. This wide choice is advantageous. By way of example, but not limitation, Figs. 8 and 9 illustrate how timing may be accomplished in response to the movement of the material which is being severed.

At numeral **67** is shown an oil sump tank. Numeral **69** indicates a pressure pump having a suction inlet **71** from the tank **67**. This pump is driven by a motor **73**. A pressure line **75** leads from the pump **69** to the pressure inlet of a four-way solenoid-operated spring-centered valve **77**. A cross section of this valve is indicated in Fig. 8. Its spool **79** is normally centered by means of compression springs **81**. The plungers of solenoids **83** and **85** are adapted to move the spool to its extreme positions when the respective solenoids are energized. Thus when the solenoid **83** is energized, the spool **79** is moved to the right to connect pressure line **75** with a connection **87** to the left side of piston **2**. At this time connection **89** from the right side of the piston **2** exhausts back to the tank **67** through connection **91**. On the other hand, when the solenoid **85** is energized, the spool **79** is moved to the left, thus bringing pressure to the right side of piston **2** through connections **75** and **89**, while exhausting from the left side of piston **2** through connections **87** and **93**. When neither solenoid is energized, the spool **79** spring centers and pressure is cut off from both sides of the piston **2**. Both sides of piston **2** are then connected to exhaust.

At numeral **95** is shown a low-voltage supply circuit, one side **94** of which supplies signal current in parallel to two relays **97** and **99**. The control side of relay **97** is connected to one side of a limit switch **101** and the control side of relay **99** to one side of a limit switch **103**. The other side **96** of the circuit **95** connects directly with one side of the limit switch **103**. This other side **96** also connects with limit switch **101** through a brush circuit indicated at **105**. This circuit **105** includes a ground connection **107** to the incoming material M and a connection **109** from **101** to a trolley **110**. A contact brush **111** is movable along the trolley **110**. The brush, in any of its adjusted positions along the trolley **110**, is adapted to be contacted by the advancing end of the material M. The power sides of the relays are supplied with current over a main power supply line **113**. Relay **97** supplies current to solenoid **83** and relay **99** supplies current to solenoid **85**.

Starting with the position of parts shown in Fig. 9 (piston **2** retracted to the left and material M having not reached the brush **111**), a previously severed part such as **115** has fallen away from the brush **111** (Fig. 5) and the circuit **105** is opened. Since limit switch **103** is at this time open, no current flows to either relay **97**, **99**, or to either solenoid **83** or **85**. The valve **77** is then spring centered and neither side of the piston **2** is supplied with any pressure, both sides being connected to exhaust to the tank **67**.

As the material M advances, it contacts the brush **111**, thus closing the circuit **105** which, through closed limit switch **101**, energizes relay **97** and coil **83**. This moves the spool **79** to the right, thus sending pressure to the left side of the piston **2**, while exhausting its right side to the tank **67**. The piston then advances to the right, driving the carriage **5** to the right. Near the end of the stroke, the limit switch **103** is contacted by a collar **117** on the piston rod to close it, while mechanically connected limit switch **101** is opened. This deprives relay **97** of current and supplies it to relay **99**, thus energizing solenoid coil **85** and moving the spool **79** to the left. The result then is that pressure is supplied to the right side of piston **2** and its left side connected to the sump **67**. This returns the piston under power to effect a retractive stroke of carriage **5**. As the end of the retractive stroke is reached, limit switch **101** is reclosed and limit switch **103** reopened. This again prepares the brush circuit **105** for the next power stroke, but the circuit is at this time open, because severed piece **115** (Fig. 5) has moved away from the brush **111**. The valve **77** then recenters, ready for the next cycle of operation.

The time between cycles is determined by how long it takes the advancing end of the material M to reach the brush **111**, which in turn depends upon the position of the brush **111** along the trolley **110**. Hence in order to change the lengths **115** which are being severed from M, it is only necessary to move the brush **111** along its trolley.

If it is desired manually to override the automatic cut-off operation, the brush **111** may be moved completely out of contact position with respect to the material M and by-pass switch **119** closed at the intervals at which it is desired to effect severances. Switch **119**, instead of being manually timed, may be operated by a time clock, or by a suitable timing device driven by the machine which supplies the material M. Thus it will be seen that the invention is highly adaptable to a wide variety of severing requirements.

As above noted, the material M is free to move through and independently of the cut-off mechanism the instant that severance occurs. The carriage need not follow the material while the severing means is being disengaged. This simplifies the construction and shortens the operating cycle. In connection with Fig. 6, the movement of the ram **43** due to deceleration of the carriage **5** is in the same direction as the push from the material M. This favors the stated quick and smooth release action. Adjustments at **59** and the anchor **51** provide for optimum operating characteristics at any speed.

It will be understood that while a hydraulic cylinder has been shown for the reciprocating carriage **5**, other suitable devices may be used for the purpose, such as an air cylinder, a spring-returned Edison screw with a one-revolution driving clutch, et cetera.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. Severing apparatus for acting upon continuously advancing material, comprising a frame forming a first rectilinear guide, a carriage, means to reciprocate the carriage in the guide from an initial position through forward severing and rearward retractive strokes, said carriage having a first severing element past which the material is adapted to move, said carriage having a second rectilinear guide located crosswise of the first guide, a pivoted swinging ram mounted for reciprocating movement with the carriage and carrying a second swinging severing element, crank means connecting the ram and the frame and enforcing severing movement of the ram along the second guide during forward movement of the carriage and retractive movement of the ram during retractive movement of the carriage, spring means biasing the ram toward its severing position, and latch means between the ram and the carriage adapted to lock the ram against pivoting and in severing position during said outward movement of the carriage but thereafter releasing the ram to be pivoted against its spring-biasing means by oncoming material upon retractive movement of the carriage, whereby the ram is swung aside.

2. Severing apparatus made according to claim 1, wherein said latch means is spring-biased toward locking position and is adapted to be reset by the ram in approaching its severing position upon a retractive movement of the carriage.

3. Severing apparatus for acting upon continuously advancing material, comprising a frame forming a first guide, a carriage, means to reciprocate the carriage forward and backward in the guide and along the material, a first severing element on the carriage, said carriage having a second guide located crosswise of the first guide, a double crank element journaled in the frame by a double crankshaft and having a crankpin, a ram pivoted on the crankpin and carrying a second severing element, said double crank element being oscillated by the crankshaft and the crankpin upon reciprocation of the carriage, oscillation of the crank being from an initial position wherein the second severing element is retracted laterally from the material, through a final position in which said second severing element has crossed and severed the material, and back to said initial position, and means to lock the pivoted ram for severing during forward carriage movement and to release the pivoted ram during backward carriage movement.

4. Severing apparatus made according to claim 3, wherein means is included for providing a rotary bias on the ram normally to hold its severing element toward

severing position relative to the severing element on the carriage, and wherein a downwardly biased catch is located on the carriage and a latch is located on the rotary ram so as to engage said catch when the severing element on the ram is in any severing position.

5. Severing apparatus made according to claim 4, wherein said bias means is resilient, and wherein the latch disengages the catch when the second severing element moves beyond its severing positions thereby permitting advancing material after a severance to hold aside the severing element on the ram by pivoting the ram.

6. Severing apparatus made according to claim 5, wherein the lowermost position of the catch upon retraction of the carriage admits the latch beneath it for relatching the ram when it reaches its initial position.

7. Severing apparatus comprising a frame forming a rectilinear guide, a carriage, means to reciprocate the carriage in the guide, said carriage having a rectilinear guide normal to the guide in the frame, sliding means in the carriage guide, crank means journaled in the frame, a crankpin journaled in the sliding means and in the crank means, a rotatable ram on the crankpin, severing elements supported on the carriage and the ram respectively, resilient means biasing said ram normally to engage said severing elements, and means locking the ram against rotation to maintain said engagement between the severing elements during severing, said means releasing the ram for rotation after severing.

8. Severing apparatus made according to claim 7, wherein said locking and releasing means is constituted by latching means carried by the ram and a movable catch supported on the carriage, and means biasing the catch toward a position engaging the latching means when the ram is in any severing position.

9. Severing apparatus for acting upon continuously advancing material comprising a frame forming lateral guides, a carriage arched between the guides, means to reciprocate the carriage in the guides, said carriage having additional guides which are located transversely to the guides in the frame, a first severing element on the carriage, the carriage and severing element admitting passage of the material, a double-cheeked crank journaled in the frame and straddled by the carriage, a crankpin extending through the crank cheeks, slides in the carriage guides, in which slides the ends of said crankpin are journaled, whereby the crank is rotary in response to carriage movement, a rotary ram journaled on the crankpin between the crank cheeks and carrying a second severing element adapted to cooperate with said first severing element on the carriage, said ram being movable to and from the material in response to crank rotation, latch means between the carriage and the ram whereby the ram when in an elevated position is held so that its severing element cooperates with the severing element on the carriage, said latch means being releasable in response to ram descent upon crank rotation to allow rotary movement of the ram.

10. Severing apparatus made according to claim 9, wherein said ram after release is movable upon return of the carriage into its position to be latched, and means adapted in such position of the ram automatically to latch it.

11. Severing apparatus for acting upon continuously advancing material, comprising a frame forming a first guide in the general direction of forward material movement, a carriage, means to reciprocate the carriage in the guide from an intial position through forward severing and rearward retractive strokes, said carriage having a first severing element past which the material is adapted to move, said carriage having a second guide located generally crosswise with respect to the first guide, a crank assembly rotatable in the frame and including a pivot means engageable with said second rectilinear guide, whereby upon reciprocation of the carriage in the first guide said crank assembly will rotate relative to the frame and said pivot means will have a first component of movement equal to that of the carriage and a second component of approaching and recessive crosswise movement relative thereto, a rotatable ram on said pivot means and carrying a second severing element engageable with said first severing element, spring means rotatably biasing the ram toward a position for such engagement but allowing the ram to be rotatably swung aside by the advancing material after a

severance, and latch means operative between the ram and the carriage adapted to hold the ram when it is in recessive position to engage the severing elements for relative severing movement during forward movement of the carriage, said latch means automatically releasing the ram in its final approached position of severance, whereby the ram may be swung aside by advancing material.

12. Severing apparatus for acting upon continuously advancing material, comprising a frame forming a first rectilinear guide in the direction of forward material movement, a carriage, means to reciprocate the carriage in the guide from an initial position through forward severing and rearward retractive strokes, said carriage having a first severing element past which the material is adapted to move, said carriage having a second rectilinear guide located substantially perpendicular with respect to the first guide, a crank assembly rotatable in the frame and including a pivot means engageable with said second rectilinear guide, whereby upon reciprocation of the carriage said crank assembly will rotate relative to the frame and said pivot means will have a first component of movement equal to that of the carriage and a second component of approaching and recessive crosswise movement substantially perpendicular thereto, a rotatable ram on said pivot means and carrying a second severing element engageable with said first severing element, spring means rotatably biasing the ram toward a position for such engagement but allowing the ram to

be swung aside by the advancing material after a severance, a lug on the ram, and biased latch means operative between the lug and the carriage adapted to be set to prevent rotation of the lug and the ram but permitting ram severing movement during forward movement of the carriage, said latch means automatically releasing the lug of the ram in the ram's final position of severance, whereby the ram becomes rotatable and may be swung aside by advancing material, said lug being adapted to reset the latch when the carriage is retracted and the ram recedes from its severing position.

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